

hMSCs Cultured on Plant-Derived Tissue Engineering Extracellular Matrix in a Microgravity Environment

Completed Technology Project (2013 - 2017)



Project Introduction

The objective of this proposal is to fabricate an all plant-derived renewable, biodegradable complete mimic of the bone extracellular matrix (ECM). For the first time in space research technology, plant-derived materials will be used to fabricate fully plant-derived mimics of the ECM as constructs to study the underlying cellular mechanisms responsible for the alteration of bone cells as a result of microgravity during space missions. Net bone mass is dictated by the relative activities of bone cells, osteoclasts and osteoblasts, both of which have been found to be affected by microgravity environment. In order to understand the underlying cellular mechanisms, in vitro cell studies are conducted in simulated microgravity environments, but appropriate constructs are needed. By supplying the bone cells with a biomaterial that closely resembles their native ECM, the variables affecting cell behavior may be reduced to microgravity alone. Plant-derived materials have natural properties and molecular structures resembling the constituent fiber proteins and the glycosaminoglycans in the native ECM; thus, the use of these materials to completely mimic the bone ECM appears appropriate. Preliminary data revealed that the materials and methods utilized to fabricate the constructs provided a suitable environment for human mesenchymal stem cells lineage (bone cell precursors). By creating tissue engineering complete mimics of bone ECM for in vitro cell studies in simulated microgravity environment, a better understanding of the effects that microgravity has on bone can be achieved. This is a step closer toward potential treatment for microgravity-induced bone loss.

Anticipated Benefits

By creating tissue engineering complete mimics of bone ECM for in vitro cell studies in simulated microgravity environment, a better understanding of the effects that microgravity has on bone can be achieved. This is a step closer toward potential treatment for microgravity-induced bone loss.



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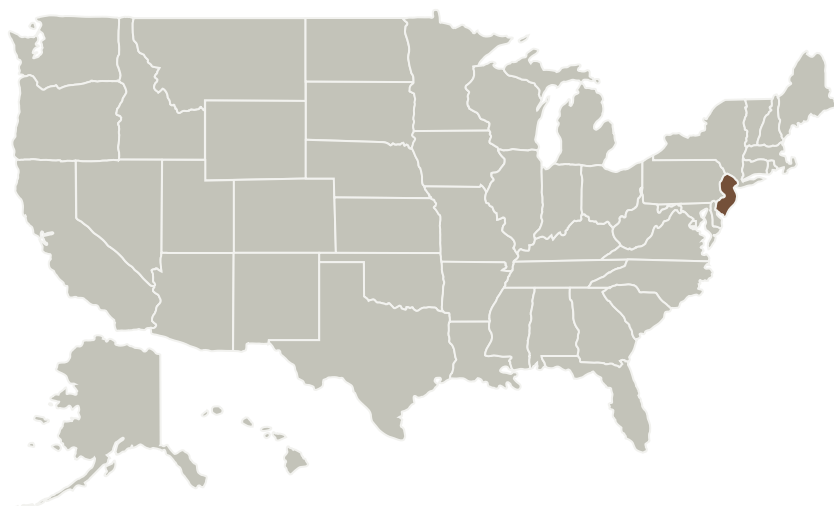
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Primary U.S. Work Locations and Key Partners



| Organizations Performing Work | Role | Type | Location |
|--|-------------------|----------|--------------------|
| New Jersey Institute of Technology(NJIT) | Lead Organization | Academia | Newark, New Jersey |

Primary U.S. Work Locations

New Jersey

Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

New Jersey Institute of Technology (NJIT)

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

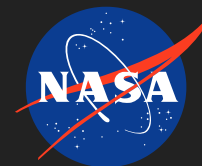
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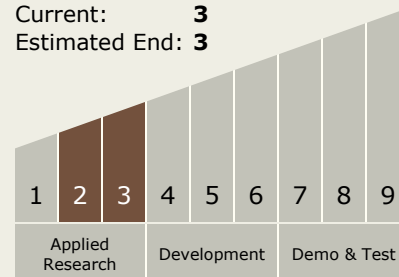
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Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
 - └ TX06.3 Human Health and Performance
 - └ TX06.3.6 Long Duration Health

Target Destinations

Earth, The Moon, Mars